

Remarks:

Reconsideration of the application is requested.

Claims 1-10 remain in the application. Claim 1 has been amended. A marked-up version of the claim is attached hereto on a separate page.

In the second paragraph on page 2 of the above-identified Office Action, claims 1-10 have been rejected as being unpatentable over Matsumura (JP 3-64081) in view of Nishigaki et al. (US 4,363,993) under 35 U.S.C. § 103(a).

The rejection has been noted and claim 1 has been amended in an effort to even more clearly define the invention of the instant application. Support for the changes is found on page 5, lines 20-23, page 6, lines 18-20, page 7, lines 7-12, page 8, lines 1-4, and page 11, lines 20-25 of the specification of the instant application.

Before discussing the prior art in detail, it is believed that a brief review of the invention as claimed, would be helpful. Claim 1 calls for, *inter alia*, a piezoelectric bending transducer, comprising a piezoelectrically active layer applied to at least one of the sides of a supporting element, and an adaptation layer applied to the active layer and having a given constant thickness, a given length, and a given width

for providing the adaptation layer with a predefined volume that compensates for and reduces the thermal distortion in the bending transducer.

Thus, an important aspect of the present invention is to provide a piezoelectric bending transducer having inherent thermal distortion with a piezoelectrically active layer applied to at least one side of a supporting element, and an adaptation layer of a predefined volume applied to the piezoelectrically active layer, wherein the predefined volume of the adaptation layer is sufficient to reduce and compensate for thermal distortion in the transducer. The predefined volume is determined by intentionally selecting a particular given thickness, length, and width for the adaptation layer.

The Matsumura reference discloses piezoelectric bimorph element in which a relatively small insulating ceramic unit 4 is formed on a piezoelectric ceramic plate 1A. See Figs. 1(a), (b), and (c). Matsumura is particularly concerned with selecting a particular ceramic material to reduce and minimize the thermal expansion coefficient difference between the ceramic plate and the ceramic unit. There is absolutely no suggestion or disclosure of using the volume of an adaptation layer (albeit the ceramic unit 4) to reduce and compensate for thermal distortion in a bending transducer.

It is respectfully submitted that the electrically insulating ceramic unit 4 disclosed in Matsumura is not an adaptation layer as recited in the claims.

As discussed above, the adaptation layer according to the present claimed invention reduces the distortion of the bending transducer in that it compensates for internal distortion. A certain amount of distortion inherently occurs in the bending transducer when no adaptation layer is present. The application of the adaptation layer of a predefined volume on the bending transducer functions to at least partially compensate for and reduce the inherent distortion that normally occurs in the bending transducer, i.e. it cancels the inherent torsional forces acting on the bending transducer in the absence of an adaptation layer.

The insulating ceramic unit 4 disclosed in Matsumura is provided for the purpose of insulating a piezoelectric bimorph transducer against leakage and for proper power transmission (see the disclosure under the paragraph entitled PURPOSE). The ceramic unit, however, is not provided for the purpose of compensating for thermal distortion that occurs in the bimorph transducer, i.e. to counteract a distortion of the bimorph transducer which may occur in the absence of the ceramic unit. On the contrary, it is readily recognized that the ceramic unit per se causes a thermal deformation of the bimorph

transducer, because it alters the symmetry of the transducer as shown by its location in Fig.1. Matsumura proposes to use a ceramic unit that, contrary to the adaptation layer of the present claimed invention, is intended to influence the thermal behavior of the bimorph transducer as little as possible. Please refer to the last sentence of the section entitled CONSTITUTION. According to Matsumura, this is achieved because the thermal expansion coefficient of the ceramic unit is coordinated with the thermal expansion coefficient of the adjacent piezoelectric ceramic plate 1A to minimize warpage of the ceramic plate. Therefore, the ceramic unit can exert only a negligible, if any, torsional force on the bimorph transducer.

The influence of the ceramic unit on the thermal bending behavior of the bimorph transducer is further reduced, as can readily be determined by one skilled in the art, because the ceramic unit is only connected with the piezoelectric ceramic plate in a small area and the ceramic unit is located in a corner point of the free end of the bimorph transducer as illustrated in Fig. 1. Accordingly, because of its location and design the ceramic unit cannot function to reduce thermal distortion or effectively influence the bending behavior of the bimorph transducer.

The teaching and disclosure of Matsumura is completely different from the present invention. The ceramic unit of Matsumura is not at all suitable as an adaptation layer to compensate for thermal distortion of a bending transducer as claimed, but rather it only reduces thermal deformation which it causes itself. Matsumura does not teach or suggest using an adaptation layer for the compensation of the thermal distortion of a bending transducer.

The Nishigaki reference discloses an electro-mechanical transducer having a first layer with opposing major surfaces made of a piezoelectric material, a pair of electrodes formed on the major surfaces of the first layer, and a second layer clamped at its one surface to one of the surfaces of the first layer. There is no suggestion or disclosure in the reference to compensate for or reduce inherent thermal distortion in a piezoelectric bending transducer, or to provide an adaptation layer of predetermined volume for reducing and compensating for such distortion.

Clearly, neither Matsumura nor Nishigaki teach or disclose "an adaptation layer applied on said piezoelectrically active layer, said adaptation layer having a given constant thickness, a given length and a given width, thereby providing a predefined volume for at least partially compensating and

reducing inherent thermal distortion in said bending transducer," as recited in claim 1 of the instant application.

It is accordingly believed to be clear that none of the references, whether taken alone or in any combination, either show or suggest the features of claim 1. Claim 1 is, therefore, believed to be patentable over the art. The dependent claims are believed to be patentable as well because they all are ultimately dependent on claim 1.

In view of the foregoing, reconsideration and allowance of claims 1-10 are solicited.

In the event the Examiner should still find any of the claims to be unpatentable, counsel would appreciate receiving a telephone call so that, if possible, patentable language can be worked out. In the alternative, the entry of the amendment is requested, as it is believed to place the application in better condition for appeal, without requiring extension of the field of search.

Please charge any fees that might be due with respect to  
Sections 1.16 and 1.17 to the Deposit Account of Lerner and  
Greenberg, P.A., No. 12-1099.

Respectfully submitted,



For Applicants

FDP/tk

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Version With Markings to Show Changes Made:

Claim 1 (Twice Amended). A piezoelectric bending transducer, comprising:

a supporting element having opposite sides;

a piezoelectrically active layer applied to at least one of said sides of said supporting element; and

an adaptation layer disposed on said piezoelectrically active layer, said adaptation layer having a given constant thickness, [one of] a given length and a given width, thereby providing [and] a predefined volume for at least partially compensating and reducing inherent thermal distortion[, said adaptation layer applied to said piezoelectrically active layer] in the piezoelectric bending transducer.